PROJECT-X1 xx1 SRR and SDR Report

July 2004

Executive Summary

The PROJECT-X1 IV&V team participated in the xx1 Systems Requirements Review (SRR), held in November and December 2003, and the System Definition Review (SDR) held in March and April 2004. The IV&V team effort consisted of artifact evaluation and participation in issue disposition and document review forums. The objective of the IV&V activities was to assure the system and xx2 requirements were complete, viable, and traceable to their parent requirements. The IV&V results and conclusions are summarized in the following paragraphs.

The IV&V team's effort resulted in 101 issues captured and tracked in the IV&V Project Issues Tracking System (PITS). Of these, 56 were generated from the review of two versions of the System Segment Specification and 45 were generated from the review of the xx1 Specification. The issue severity distribution revealed that 48% of the issues were classified as low severity (4 and 5) or editorial, 52% carried a higher severity (3) impact potential, and only 2% were classified in the highest severity (1 and 2) categories. The highest severity issues are summarized as follows:

- The xx1 Specification does not include a requirement to blend the control moments provided by the xx2 and those provided by the xx3. IV&V recommends the addition of requirements similar to what the xx4 uses.
- The xx1 Specification does not require an entry flight control transition from xx2 to xx3 control. IV&V recommends the addition of requirements similar to what the xx4 uses.

The final disposition of IV&V generated SRR issues have been captured in this document. However, the final disposition of the SDR issues is currently ongoing.

The IV&V team concludes that the SRR and SDR reviews significantly improved the PROJECT-X1 requirements maturity. The expected baselining of the system and xx1 specifications should place the project in a satisfactory posture to proceed to the design development phase. The IV&V team recommends the prompt completion of follow-through actions and disposition of all pending requirements issues.

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1 Introduction

This report documents the Independent Verification and Validation (IV&V) analysis support provided to the PROJECT-X1 project xx1 Systems Requirements Review (SRR) and System Definition Review (SDR) forums. The SRR activities were conducted during November and December 2003 and the SDR activities were conducted in March and April 2004.

The IV&V team objectives for the SRR and SDR were aligned with the project objectives. Specifically, the IV&V team's effort was to assure the system and xx1 requirements were complete, viable, and traceable to their parent requirements. This activity is expected to facilitate the project's progression to the design phase.

The tasks performed under this IV&V activity were conducted according to the PROJECT-X1 IV&V Project Plan, dated October 2, 2003.

The following sections describe the analysis configuration, the analysis performed, and the results obtained.

2 Analysis Configuration

This section presents the IV&V analysis scope, lists the PROJECT-X1 artifacts under evaluation, presents references, and details the tools used in the conduct of these assessments.

2.1 Analysis Scope

The PROJECT-X1 IV&V team requirements analysis effort in support of the SRR and SDR was focused on the assessments of SRR and SDR artifacts. The IV&V team also supported teleconferences created for the Review Item Disposition reviews.

2.2 Artifacts Under Evaluation

The artifacts presented in Tables 2-1 and 2-2 were the source of information for the IV&V SRR and SDR support effort. These artifacts were placed and maintained under IV&V Configuration Management.

Table 2-1 SRR Artifacts Under Evaluation

Document Number	Title	Rev	Date
xx1-001	xx1 Requirements Verification Document	A	xx/xx/xxxx
xx1-002	Concept of Operations For the PROJECT-X1 xx1	B	xx/xx/xxxx
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[REMOVED]			

Table 2-2 SDR Artifacts under Evaluation

Document Number	Title	Rev	Date
xx1-001-001	PROJECT-X1 xx1 to xx2 Interface Requirements Document	Draft	xx/xx/xxxx
xx1-001-002	Master Requirements Verification Document PROJECT-X1 xx1 System	C	xx/xx/xxxx
xx1-001-003	Reliability and Maintainability Plan	A	xx/xx/xxxx
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	[REMOVED]		

2.3 Analysis Support Tools

The tool listed in Table 2-4 below was used to support the PROJECT-X1 IV&V SRR and SDR analysis.

Table 2-4 IV&V Tools

TOOL	Use	Source
Project Issues Tracking System (PITS)	Project issue and risk tracking system	-
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3 Description of Analysis Performed

The IV&V team SRR and SDR requirements analysis was performed to ensure the requirements formed a proper base for design. The task was composed of the following elements:

1. Verify requirements documents meet intended purpose, have appropriate level of detail, and contain all necessary elements to meet system needs.
2. Verify the requirements traceability to and from parent requirements.

4 Analysis Results

This section captures the results of the PROJECT-X1 IV&V team support to the xx1 SRR and SDR reviews. The section also characterizes the issues in terms of state and severity. For brevity, only the severity 1, 2, and 3 issues are captured in this section. Complete listings of issues are captured in Appendices A and B of this document.

The severity descriptions used to classify issues in this section and in the Appendices were based on the IEEE J-STD-016-1995 standard presented in Table 4-1.

Table 4-1 Issue Severity Descriptions

Severity	**Description**
1	a) Prevent the accomplishment of an essential capability b) Jeopardize safety, security, or other requirement designated critical
2	--
	[REMOVED]

The issue states assigned in tables in this section and in the Appendices are defined in Table 4-2.

Table 4-2 Issue State Descriptions

State	Description
Open	Issue has passed peer review and is ready for submittal to a disposition board. If the disposition is not known, the issue remains in the open state.
Closed	Issue disposition has been verified.
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	[REMOVED]

4.1 SRR Review Results

The xx1 SRR Review was conducted in November and December 2003. The IV&V effort was focused on the review of the PROJECT-X1 xx1 Specification, Draft, released on September 21, 2003. The IV&V team submitted 12 issues. Of these, 7 were considered editorial documentation corrections and one was dispositioned as no-issue. The high severity (1, 2, or 3) issues and their disposition are captured in Table 4-3 below. The complete set of issues is captured in Table A-1 of Appendix A. One high severity issue generated during the SRR review remains open, and is discussed in detail below.

Table 4-3 SRR xx1 Specification High Severity Issues

ID	State	Severity	Count	Subject	Impact	Disposition
1000	Resolved	3	2	Missing FDIR requirements	Incomplete requirements could cause confusion ….	Valid

[REMOVED]

4.1.1 SRR Open High Severity Issues

One high severity issue generated during the SRR review remains open. The issue is discussed below.

Subject: Missing xx1 xxx Requirements for Entry xxx Control (TIM-1007)
Severity: 3 (Affects essential capability)

Document: PROJECT-X1 Flight System/xx1 Specification, Draft
Description: The flight control requirement for xx, paragraph x.x.x, does not include the use of xxx for xxx.
Discussion: A requirement that includes xxx control during xxx exists in paragraph x.x.x of the updated. However, the definitions included in the document for xxx and xxx are mutually exclusive. xxx is defined as the transition from space to xxx flight, and xxx is defined as xxx that begin at the end of xxxx including the xxx interface. A verbal agreement was made at the SRR TIM review that if the xxx definition were to cover xxx and xxx then the xxx requirement would be covered in the xxxx paragraph.
Recommendation: The IV&V team recommends the addition of the use of xxx for xxx control in the xxxx and xxx paragraph.

4.1.2 SRR Observation

The SRR review resulted in significant improvements to the xxx System xxx Specification requirements. The improvements proved vital for the subsequent SDR review.

4.2 SDR Review Results

The SDR was conducted in March and April 2004. The IV&V support was focused on the review of the xx1 Flight System/xxx Specification, released on xx/xx/xxx, the updated System/xxx Specification, released on xx/xx/xxxx, and the PROJECT-X1 xx1 Specification, newly released on xx/xx/xxxx. The IV&V team generated xx issues against the System/xxx Specification and xx issues against the xxx1 Specification. Of these, xx were considered editorial documentation corrections and xx were dispositioned as no-issue. The high severity (1, 2, or 3) issues and their disposition are captured in Tables 4-4 and 4-5 below. The complete sets of issues are captured in Appendix B, Tables B-1 and B-2.

Table 4-4 SDR High Severity System Spec Issues

ID	State	Severity	Count	Subject	Impact
1125	Open	3	4	Missing Requirement for Accuracy of xxx	With the accuracy of xxx unconstrained, control of xxx to required accuracy may not be achieved.
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ID	State	Severity	Count	Subject	Impact

[REMOVED]

Table 4-5 SDR High Severity xxx Spec Issues

ID	State	Severity	Count	Subject	Impact	Disposition
1231	Open	3	1	Missing Software Safety Standard Requirement	Missing requirement has major impact on …	Pending
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[REMOVED]

4.2.1 Discussion of results

The resolution of all issues lodged against the System/xxx Specification remained open, as the IV&V team did not have access to the xxx database to determine the issue disposition. The same situation occurred with the xx1 Specification issues, with the exception that an updated document was released midway through the review. The updated xx1 Specification allowed the disposition of some of the IV&V generated issues.

4.2.2 Open High Severity Requirements Analysis Issue

Twenty-four high severity (1, 2, and 3) issues against the SDR System and xx1 Specifications remain open as the disposition of these issues is unknown by the IV&V team at this time. Of these, one was classified as severity 2 and is discussed in detail below.

Subject: Missing xx1 System Requirements (xxx-TIM-1111)
Severity: 2 (Affects essential capability, no known work around)
Document: PROJECT-X1 xx1 xxx Specification, Rev A
Description: issue description
Discussion: Detail discussion
Recommendation: IV&V recommendations.

4.2.3 SDR Observation

The SDR review resulted in significant improvements to the xx1 System and xxx Specification requirements. The most significant event during the SDR was the complete re-write of the xxx specifications. Once the requirement documents are baselined, the project is expected to proceed to the design phase.

4.3 Issue Characterization

This section describes the SRR and SDR analysis results in terms of issue state and severity for each document evaluated.

4.3.1 Issue State

The current state of the IV&V issues for each document evaluated is presented in Table 4-6. The table details the number of issues raised, the number that remain open, those that were closed, the issues resolved, the number that were dispositioned as no-issue, and those that were withdrawn. The open issues are those that remain to be dispositioned by the review boards. The number of issues accepted as valid by the review boards is the sum of the resolved and closed issues. The resolved issues are those that the disposition board has accepted as valid, however, the IV&V team has not been able to verify the correction has taken place in the pertinent document. The withdrawn issues are those determined to have no merit prior to submittal to the review boards.

Table 4-6 IV&V SRR and SDR Issue State Distribution

Document	Issues	Open	Resolved	Closed	No Issue	Withdrawn
xxx			X	-		
--		X		-		
--		X		-		
Totals	xx	Xx		-		

The largest number of issues was found in the xxx Specification. This is expected as more detailed requirements are contained in this document and a larger proportion of the IV&V team effort was focused on this document.

4.3.2 Issue Severity

Table 4-7 below shows the issue distribution by severity. As expected the issue population generally increases as the severity decreases. The low severity issues (severity 4 and 5) were the largest proportion of issues found and encompassed xx% of all issues. The next largest groups were the severity 3 classifications, with xx% of the total population. The severity 2 issues only accounted for xx% of the total.

Table 4-7 xx1 SRR and SDR Issue Severity Distribution

		Severity				
Document	**Issues**	**1**	**2**	**3**	**4**	**5**
--	x		-	-	-	-
--	X					
	X					
Totals	Xxx					

5 Conclusions and Recommendations

Summary

The PROJECT-X1 IV&V team participated in the xx1 System Requirements Review (SRR) and System Definition Review (SDR) forums conducted in the November - December and March - April 2004 time periods respectively. The IV&V effort consisted of the review of artifacts provided and in the participation in issue disposition or document review teleconferences. The IV&V team submitted xxxx issues both formally and informally via e-mail.

The IV&V generated issue severity distribution revealed that xx% of the issues were classified as low severity or editorial, xx% carried a higher severity impact potential, and only xx% were classified in the highest severity categories.

Conclusion

The SRR and SDR review processes significantly improved the PROJECT-X1 xx1 requirements maturity. The expected baselining of the system and segment specifications should place the project in a satisfactory posture to proceed to the design development phase.

Recommendations

The IV&V team recommends the prompt completion of follow-through actions and disposition of all pending requirements issues. This should result in the timely baselining of the requirement documents.

Appendix A: SRR Issues

The IV&V generated SRR issues are presented in this table. The resolved state means the issue was accepted by the review board, but IV&V cannot verify changes to the document at this time.

TableA-1 SRR System Spec Issues

TIM	State	Severity	Count	Subject	Impact
1001	Closed	3	2	xxx Requirements	Incomplete requirement could cause confusion when lower level requirements are developed
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[REMOVED]

Appendix B: SDR Issues

This appendix presents the complete set of issues that the IV&V team generated during the System Definition Review (SDR) conducted in March and April 2004.

Table B-1 SDR System xxx Spec Issues

TIM	State	Severity	Count	Subject	Impact
1519	Open	3	1	Missing xxx xxx Requirements	xx1 performance requirements may not be met if error in xxx of xxx is unconstrained
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[REMOVED]

6 Acronyms

DID	Data Item Description
FDIR	Fault Detection Isolation and Recovery
GN&C	Guidance Navigation & Control
ICD	Interface Control Document
IDD	Interface Definition Document
IRD	Interface Requirements Document
IV&V	Independent Verification & Validation
NASA	National Aeronautics and Space Administration
PDR	Preliminary Design Review
PITS	Project Issues Tracking System
SDR	System Definition Review
SRR	System Requirements Review
SRS	Software Requirements Specification
STD	Software Test Description
TIM	Technical Interchange Meeting